

Amendments to the Claims

Claims 1-162 (cancelled)

Claim 163. (currently amended): A parallel reactor for simultaneously processing a plurality of reaction mixtures, said reactor comprising
vessels for containing the reaction mixtures, and
multi-piece spindles for stirring the reaction mixtures in the vessels, each multi-piece spindle comprising a metal upper spindle portion, a single use plastic stirrer comprising a shaft having a plastic core and a plastic mixing blade on the shaft, and a coupling for releasably coupling the plastic stirrer to the metal upper spindle portion in a position wherein the stirrer extends down into a respective vessel,
said plastic stirrer being removable from said coupling after a mixing operation to permit discard and replacement of the stirrer after a single use.

Claim 164. (previously presented): A parallel reactor as set forth in claim 163 wherein said stirrer is of a chemically resistant plastic material.

Claim 165. (currently amended): A parallel reactor as set forth in claim 164 wherein said coupling is attached to the upper spindle portion for rotation therewith, and wherein said shaft of the stirrer has a quick-connect/disconnect element thereon adapted for releasable engagement with said coupling and for preventing relative rotation of the coupling and the stirrer.

Claim 166. (previously presented): A parallel reactor as set forth in claim 165 wherein said quick-connect/disconnect element comprises a circumferential groove around said shaft for receiving one or more detents in the coupling.

Claim 167. (previously presented): A parallel reactor as set forth in claim 163 further comprising a drive system for rotating the multi-piece spindles to mix the contents of the vessels.

Claim 168. (previously presented): A parallel reactor as set forth in claim 167 wherein said drive system comprises a drive mechanism located external to the vessels, and magnetic feed through devices for magnetically coupling the drive mechanism to the upper spindle portions of the multi-piece spindles.

Claim 169. (previously presented): A parallel reactor as set forth in claim 168 wherein said drive mechanism comprises a gear train for rotating each magnetic feed through device, and a motor for rotating gears of the gear train to effect conjoint rotation of the multi-piece spindles at speeds up to 3000 rpm.

Claim 170. (previously presented): A parallel reactor as set forth in claim 169 wherein each vessel has as volume of less than about 500 ml.

Claim 171. (currently amended): Plastic stirrers for use in stirring reaction mixtures in a parallel reactor, said reactor comprising vessels for containing said reaction mixtures, metal spindle portions associated with the vessels, couplings on the metal spindle portions for releasably coupling the plastic stirrers to the spindle portions in positions wherein the stirrers extend down into the vessels, and a drive system for rotating the metal spindle portions and the plastic stirrers coupled thereto thereby to mix the contents of the vessels, each plastic stirrer comprising a shaft having a plastic core and a plastic mixing blade on the shaft, said shaft having a quick-connect/disconnect element thereon adapted for engagement with said coupling for releasably coupling the plastic stirrer to the metal spindle portion for rotation therewith whereby upon completion of a mixing operation the plastic stirrer is adapted to be disconnected from said ~~coupling~~ coupling, discarded and replaced by a new plastic stirrer after a single use.

Claim 172. (previously presented): Plastic stirrers as set forth in claim 171 wherein said quick-connect/disconnect element comprises a circumferential groove in said shaft adapted for receiving one or more detents in the coupling.

Claim 173. (previously presented): Plastic stirrers as set forth in claim 172 wherein said quick-connect/disconnect element comprises a pin on said shaft receivable in a bayonet slot in said coupling.

Claim 174. (previously presented): Plastic stirrers as set forth in claim 171 wherein each stirrer is sized for reception in a vessel having a volume of less than 500 ml.

Claim 175. (currently amended): Plastic stirrers as set forth in claim 174 wherein each stirrer is sized for reception in a vessel having a volume of less ~~than 20 ml~~ than about 20 ml.

Claim 176. (currently amended): Apparatus for the parallel processing of reaction mixtures, comprising

a reactor block having a series of wells therein extending down from an upper surface of the block for containing the reaction mixtures,

an upper plate removably secured to said reactor block over said upper surface thereof, said upper plate having openings therein in registry with the wells in the reactor block,

stirring mechanisms attached to said upper plate and removable with the upper plate for stirring said reaction mixtures, said stirring mechanisms extending down through the openings in the upper plate and into respective wells, and

seals for sealing against leakage through said upper plate openings when the upper plate is secured to the reactor block,

each stirring mechanism comprising a drive mounted on said upper plate and a multi-piece spindle rotatable by said drive, said multi-piece spindle having a metal upper spindle portion, a single use plastic stirrer, and a coupling for releasably coupling the plastic stirrer to the metal upper spindle portion in a position wherein the stirrer extends down into a respective well, said plastic stirrer being removable from said coupling after a mixing operation to permit discard and replacement of the stirrer after a single use.

Claim 177. (previously presented): An apparatus for parallel processing of reaction mixtures comprising:

a reactor block having a series of wells therein extending from an exterior surface of the block for containing the reaction mixtures,

a removable plate removably secured to the reactor block, the removable plate having openings therein in registry with the wells in the reactor block,

a temperature control system for regulating the temperature of the reaction mixtures, and

a stirring system attached to the removable plate and removable with the removable plate for agitating the reaction mixtures, the stirring system comprising:

spindles extending into respective wells, each of the spindles having a first end portion and a second end portion,

a stirring blade attached to the first end portion of each of the spindles, and

a drive mechanism located external to the vessels that is adapted to rotate the spindles.

Claim 178. (previously presented): The apparatus of claim 208 wherein said exterior surface of the reactor block is an upper surface, and wherein said removable plate is an upper plate overlying said upper surface.

Claim 179. (currently amended): A parallel reactor for simultaneously processing a plurality of reaction mixtures, said reactor comprising

vessels for containing the reaction mixtures,

multi-piece spindles for stirring the reaction mixtures in the vessels, each multi-piece spindle comprising a metal upper spindle portion, a single use plastic stirrer comprising a shaft having a plastic core and a plastic mixing blade on the shaft, and a coupling for releasably coupling the plastic stirrer to the metal upper spindle portion in a position wherein the stirrer extends down into a respective vessel, said plastic stirrer being removable from said upper spindle portion after a mixing operation to permit discard and replacement of the stirrer after a single use, and

a drive system for rotating the multi-piece spindles to mix the contents of the vessels, said drive system comprising a drive mechanism located external to the vessels, and magnetic feed through devices for magnetically coupling the drive mechanism to the upper spindle portions of the multi-piece spindles, each upper spindle portion comprising a leg extending down from a respective magnetic feed through device.

Claim 180. (previously presented): A parallel reactor as set forth in claim 179 wherein said magnetic feed through device comprises a magnetic driver rotatable by said drive mechanism, and a magnetic follower adapted to be magnetically rotated upon rotation of the magnetic driver, said leg comprising an integral extension of said magnetic follower.

Claim 181. (previously presented): A parallel reactor as set forth in claim 179 wherein said drive mechanism comprises a gear train for rotating each magnetic feed through device, and a motor for rotating gears of the gear train to effect rotation of the multi-piece spindles at speeds up to 3000 rpm.

Claim 182. (previously presented): A parallel reactor as set forth in claim 181 wherein each vessel has as volume of less than about 500 ml.

Claim 183. (currently amended): A parallel reactor for simultaneously processing a plurality of reaction mixtures, said reactor comprising
vessels for containing the reaction mixtures, and
~~plastic stirrers comprising~~ single use plastic stirrers each a shaft having a plastic core and
a plastic mixing blade on the shaft for stirring the reaction ~~mixtures in the vessels~~ mixture in a
respective vessel,
a drive system for moving the stirrers to mix the contents of the vessels, and
a coupling for releasably connecting each stirrer to the drive system in a position wherein
the stirrer extends down into a respective vessel,
said plastic stirrer being removable from said coupling to permit discard and replacement
of the stirrer after a single use.

Claim 184. (previously presented): A parallel reactor as set forth in claim 183 wherein said stirrer is of a chemically resistant plastic material.

Claim 185. (previously presented): A parallel reactor as set forth in claim 184 wherein said shaft of the stirrer has a quick-connect/disconnect element thereon adapted for releasable engagement with said coupling.

Claim 186. (previously presented): A parallel reactor as set forth in claim 185 wherein said quick-connect/disconnect element comprises a circumferential groove around said shaft for receiving one or more detents in the coupling.

Claim 187. (previously presented): A parallel reactor as set forth in claim 183 wherein said drive system comprises a drive mechanism located external to the vessels, and magnetic feed through devices driven by said drive mechanism for rotating the stirrers.

Claim 188. (previously presented): A parallel reactor as set forth in claim 187 wherein said coupling is attached to a leg extending down from a respective magnetic feed through device.

Claim 189. (previously presented): A parallel reactor as set forth in claim 188 wherein said magnetic feed through device comprises a magnetic driver rotatable by said drive mechanism, and a magnetic follower adapted to be magnetically rotated upon rotation of the magnetic driver, said leg comprising an integral extension of said magnetic follower.

Claim 190. (previously presented): A parallel reactor as set forth in claim 187 wherein said drive mechanism comprises a gear train for rotating each magnetic feed through device, and a motor for rotating gears of the gear train to effect rotation of the magnetic feed through devices and stirrers.

Claim 191. (previously presented): A parallel reactor as set forth in claim 183 wherein said drive system comprises a gear train drivingly connected to each of said stirrers, and a motor for rotating gears of the gear train to effect movement of the stirrers.

Claim 192. (previously presented): A parallel reactor as set forth in claim 183 wherein each vessel has as volume of less than about 500 ml.

Claim 193. (currently amended): Plastic stirrers for use in stirring reaction mixtures in a parallel reactor, said reactor comprising vessels for containing said reaction mixtures, a drive system for moving the stirrers to mix the contents of the vessels, and couplings for releasably connecting the plastic stirrers to the drive system in positions wherein the stirrers extend down into the vessels, each plastic stirrer comprising a shaft having a plastic core and a plastic mixing blade on the shaft, said shaft having a quick-connect/disconnect element thereon adapted for engagement with said coupling for releasably connecting the plastic stirrer to the drive system whereby upon completion of a mixing operation the plastic stirrer is adapted to be disconnected from said ~~coupling~~ coupling, discarded and replaced by a new plastic stirrer after a single use.

Claim 194. (previously presented): Plastic stirrers as set forth in claim 193 wherein said quick-connect/disconnect element comprises a circumferential groove in said shaft adapted for receiving one or more detents in the coupling.

Claim 195. (previously presented): Plastic stirrers as set forth in claim 193 wherein each stirrer is sized for reception in a vessel having a volume of less than 500 ml.

Claim 196. (currently amended): Plastic stirrers as set forth in ~~claim 193~~ claim 195 wherein each stirrer is sized for reception in a vessel having a volume of ~~less than~~ less than 20 ml.

Claim 197. (previously presented): A combinatorial chemistry reactor system for parallel processing of reaction mixtures, said system comprising
a reactor block having a series of wells therein for holding said reaction mixtures,
a removable plate removably secured to the reactor block, the removable plate having openings therein in registry with the wells in the reactor block,
seals for sealing the wells of the reactor block to allow said reaction mixtures to react under pressure when the removable plate is secured to the reactor block, and

a stirring system supported by the removable plate and removable with the removable plate for agitating the reaction mixtures, the stirring system comprising
stirrers extending into respective wells, and
a drive mechanism located external to the wells for moving the stirrers to agitate reaction mixtures in the wells.

Claim 198. (previously presented): A system as set forth in claim 197 wherein said drive mechanism comprises a drive train for driving said stirrers, and a motor for driving the drive train.

Claim 199. (previously presented): A system as set forth in claim 198 wherein said drive train comprises a plurality of drive gears in mesh with one another and a motor for driving said drive gears.

Claim 200. (previously presented): A system as set forth in claim 197 wherein said drive mechanism comprises a plurality of drive gears on the stirrers, and one or more motors for driving said drive gears.

Claim 201. (previously presented): A system as set forth in claim 200 wherein said drive gears are in mesh and driven by a single motor.

Claim 202. (previously presented): A system as set forth in claim 197 wherein said stirrers are removably attached to said drive mechanism.

Claim 203. (previously presented): A system as set forth in claim 197 wherein said stirrers are of a non-metal chemically resistant material.

Claim 204. (previously presented): A system as set forth in claim 203 wherein said stirrers are of a polymer material.

Claim 205. (previously presented): A system as set forth in claim 197 further comprising fasteners for removably fastening said removable plate in face-to-face relation with an upper surface of said reactor block.

Claim 206. (previously presented): A combinatorial chemistry reactor system for parallel processing of reaction mixtures, said system comprising

a reactor block having a series of wells therein extending down from an upper surface of the block, said wells holding said reaction mixtures,

an upper plate removably secured to the reactor block in face-to-face relation with said upper surface, the removable plate having openings therein in registry with the wells in the reactor block,

seals for sealing the wells of the reactor block to allow said reaction mixtures to react under pressure when the removable plate is secured to the reactor block, and

a stirring system supported by the removable plate and removable with the removable plate for agitating the reaction mixtures, the stirring system comprising

stirrers extending into respective wells, and

a drive mechanism located external to the wells for moving the stirrers to agitate reaction mixtures in the wells, said drive mechanism comprising a drive train for driving said stirrers and one or more motors for driving said drive train, said stirrers being removably attached to said drive mechanism.

Claim 207. (previously presented): The apparatus of claim 177 further comprising removable liners in the wells.

Claim 208. (previously presented): The apparatus of claim 177 wherein said removable plate is removably secured face-to-face with said exterior surface of the reactor block.

Claim 209. (previously presented): A parallel reactor as set forth in claim 183 wherein said vessels comprise a series of wells extending from an exterior surface of a reactor block, said reactor further comprising a removable liner in each of the wells, wherein each of said plastic stirrers extends into a respective liner.

Claim 210. (canceled)

Claim 211. (new): A parallel reactor for simultaneously processing a plurality of reaction mixtures, said reactor comprising

vessels for containing the reaction mixtures, and

multi-piece spindles for stirring the reaction mixtures in the vessels, each multi-piece spindle comprising a metal upper spindle portion, a plastic stirrer comprising a shaft having a plastic core consisting of plastic and a plastic mixing blade on the shaft, and a coupling for releasably coupling the plastic stirrer to the metal upper spindle portion in a position wherein the stirrer extends down into a respective vessel,

said plastic stirrer being removable from said coupling after a mixing operation to permit replacement of the stirrer.

Claim 212. (new): A parallel reactor as set forth in claim 211 wherein said plastic core consists of polyethylethylketone (PEEK).

Claim 213. (new): Plastic stirrers for use in stirring reaction mixtures in a parallel reactor, said reactor comprising vessels for containing said reaction mixtures, a drive system for moving the stirrers to mix the contents of the vessels, and couplings for releasably connecting the plastic stirrers to the drive system in positions wherein the stirrers extend down into the vessels, each plastic stirrer comprising a shaft having a plastic core consisting of plastic and a plastic mixing blade on the shaft, said shaft having a quick-connect/disconnect element thereon adapted for engagement with said coupling for releasably connecting the plastic stirrer to the drive system whereby upon completion of a mixing operation the plastic stirrer is adapted to be disconnected from said coupling and replaced by a new plastic stirrer.

Claim 214. (new): Plastic stirrers as set forth in claim 213 wherein said plastic core consists of polyethylethylketone (PEEK).

Claim 215. (new): A parallel reactor as set forth in claim 163 wherein each of said vessels is sealed against fluid communication with the other vessels.

Claim 216. (new): A parallel reactor as set forth in claim 163 wherein said plastic core consists of plastic.

Claim 217. (new): A parallel reactor as set forth in claim 216 wherein said plastic core consists of polyethylethylketone (PEEK).

Claim 218. (new): A parallel reactor as set forth in claim 216 wherein said plastic core consists of polytetrafluoroethylene (PTFE).

Claim 219. (new): Plastic stirrers as set forth in claim 171 wherein said plastic core consists of plastic.

Claim 220. (new): Plastic stirrers as set forth in claim 219 wherein said plastic core consists of polyethylethylketone (PEEK)

Claim 221. (new): Plastic stirrers as set forth in claim 219 wherein said plastic core consists of polytetrafluoroethylene (PTFE).

Claim 222. (new): A parallel reactor as set forth in claim 179 wherein each of said vessels is sealed against fluid communication with the other vessels.

Claim 223. (new): A parallel reactor as set forth in claim 179 wherein said plastic core consists of plastic.

Claim 224. (new): A parallel reactor as set forth in claim 223 wherein said plastic core consists of polyethylethylketone (PEEK)

Claim 225. (new): A parallel reactor as set forth in claim 223 wherein said plastic core consists of polytetrafluoroethylene (PTFE).

Claim 226. (new): A parallel reactor as set forth in claim 183 wherein each of said vessels is sealed against fluid communication with the other vessels.

Claim 227. (new): A parallel reactor as set forth in claim 183 wherein said plastic core consists of plastic.

Claim 228. (new): A parallel reactor as set forth in claim 227 wherein said plastic core consists of polyethylethylketone (PEEK)

Claim 229. (new): A parallel reactor as set forth in claim 227 wherein said plastic core consists of polytetrafluoroethylene (PTFE).

Claim 230. (new): Plastic stirrers as set forth in claim 193 wherein said plastic core consists of plastic.

Claim 231. (new): Plastic stirrers as set forth in claim 230 wherein said plastic core consists of polyethylethylketone (PEEK)

Claim 232. (new): Plastic stirrers as set forth in claim 230 wherein said plastic core consists of polytetrafluoroethylene (PTFE).

Claim 233. (new): A method of making and characterizing materials within a parallel reactor apparatus by simultaneously processing a plurality of reaction mixtures, said method comprising the steps of:

providing vessels of said parallel reactor apparatus with starting materials to form said reaction mixtures;

coupling a plurality of single use plastic stirrers with respective stirring mechanisms of said parallel reactor apparatus for rotating said plastic stirrers;

positioning the plurality of plastic stirrers to extend into respective vessels for contact with the reaction mixtures;
simultaneously stirring the reaction mixtures;
removing the plurality of plastic stirrers from the stirring mechanisms after the stirring;
and
discarding said plurality of plastic stirrers after a single use.

Claim 234. (new): A method as set forth in claim 233 further comprising coupling a further plurality of single use plastic stirrers to said stirring mechanisms after said removing.